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ABSTRACT

Comparative analyses of the scientific knowledge bases of/for the teaching profession in the different European cultural contexts highlight both a large number of persisting problems and a rich potential for solutions. Integrating different culturally-relevant solutions and recent insights submitted by educational sciences in general and different Didaktik (didactics) in particular, this paper discusses a concept of Didaktik/Fachdidaktik (D/F) as an integrative transformation science dealing with teaching/studying/learning processes. The rationale for this concept is discussed. Excluding some important components of this concept (e.g., the learner), the paper focuses on the relationships of different types of knowledge relevant for teaching and the teaching profession. The concept of D/F seems to have enormous potential for developing a scientific knowledge base of/for the teaching profession. This paper discusses the development of a cross-European electronic and adaptive textbook on D/F. This textbook is being prepared by a team of authors from 12 European cultural contexts who have heterogeneous academic backgrounds. Results of an evaluation of one part of the electronic textbook on D/F are presented. Implications for improvements to teacher education programs are discussed. (Contains approximately 82 references.) (SM)

SEARCHING FOR A MISSING LINK – TOWARDS A SCIENCE OF/FOR THE TEACHING PROFESSION

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"Every study or subject thus has two aspects:
one for the scientist as a scientist;
the other for the teacher as a teacher.
These two aspects are in no sense opposed or conflicting.
But neither are they immediately identical" (J. DEWEY).

Abstract

Comparative analyses of the (scientific) knowledge base(-s) of/for the teaching profession in the different European cultural contexts highlight both a large number of persisting problems and, at the same time, a rich potential of particular solutions. Integrating different (culturally/context-bound) solutions and recent insights submitted by *"Erziehungs-wissenschaften"* (literally translated as educational sciences) in general and different *Didaktik(-en)* (literally translated as "didactics") in particular the paper will bring to discussion a concept of *Didaktik/Fachdidaktik* (D/F) as an integrative transformation science dealing with teaching/studying/learning processes *(1)*. The rationale of this concept will be described and discussed. Excluding some important components of this concept (e.g. the learner) in this paper, the focus will be put on the relationships of different types of knowledge relevant for teaching and the teaching profession. This concept of *Didaktik/Fachdidaktik* seems to have enormous potential to develop a scientific knowledge base of/for the teaching profession.

First results of the development of a cross-European electronic and adaptive textbook on *Didaktik/Fachdidaktik* will be presented, which can be seen as a materialization of the D/F concept. This electronic textbook will be prepared by a team of authors of twelve different European cultural contexts and the members of this team hold rather heterogeneous academic background (e.g. educational sciences and instructional psychology, math, social and cultural sciences, information and communication technology, and communication sciences). First results of an evaluation of one part of the electronic textbook on DF will be presented. Implications for improvements of programs of teacher education will be discussed.

Preliminary remarks

As a concrete outcome of a European-wide project on the evaluation and perspectives of a large number of higher education studies with teacher education (TE) as one of them (SIGMA-project commissioned by the European Commission, DG XXII) the European Commission has established so-called thematic networks within the cross-European action-scheme SOCRATES. The report on the evaluation and perspectives of TE in the Member States of the European Economic Area has been submitted by T. SANDER, F. BUCHBERGER, A. GREAVES & D. KALLOS in 1996 (second updated edition 2000).

Established in 1996 the Thematic Network on Teacher Education in Europe (TNTEE) may be seen as an outcome of the SIGMA-project. TNTEE is a big Pan-European network of institutions of TE and is dealing with core problems of TE in a number of sub-networks. These sub-networks may be seen as meeting places for teacher educators and teacher education researchers aiming at improvements of TE in an integrated way both at a theoretical level and in concrete cross-European research and development projects. All work done by TNTEE and its sub-networks may be found at http://tntee.umu.se (e.g. the Green Paper on Teacher Education in Europe edited by F. BUCHBERGER, B. CAMPOS, D. KALLOS & J. STEPHENSON 2000).

One sub-network of TNTEE (sub-network E: *Didaktik/Fachdidaktik* as science(-s) of the teaching profession?) has focused its research and development on the role of *Didaktik* ("didactics"), *Fachdidaktik(-en)* ("subject-related didactics") and *Bereichsdidaktik(-en)* (literally translated as didactics of various learning areas) and their potential to contribute to the improvement of the quality of teaching/studying/learning processes both in schools and TE. Additionally, it explores the potential of *Didaktik/Fachdidaktik/Bereichsdidaktik* to become (a) science(-s) of/for the teaching profession. In 1999 this sub-network consisting of experts of different academic disciplines and coming from thirteen different European countries have published their work (B. HUDSON, F. BUCHBERGER, P. KANSANEN & H. SEEL 1999).

In addition, a number of universities represented in TNTEE sub-network E have made a successful application to the European Commission action scheme SOCRATES (ERASMUS/European modules) to support the development of a European-wide, electronic and adaptive textbook on *Didaktik/Fachdidaktik/Bereichsdidaktik (*EMDID*)*. Since 7/1998 this EMDID-group has developed this textbook. First parts of it (e.g. "schooling/*"Bildung"* ("erudition/education")/teaching", integrative math education, evaluating the quality of curricular material) have already been submitted and evaluated in TE programs in different European cultural contexts.

This paper may be seen in close relationship with ongoing work of sub-network E of TNTEE and the SOCRATES/European module EMDID mentioned. In its first chapters it is a modified and enlarged version of the publications "Scientific bases of initial teacher education and their relevance to evaluate it - between the state of practice and the state of the art" (F. BUCHBERGER 1998a) and "Didaktik/Fachdidaktik as science(-s) of the teaching profession?" (F. BUCHBERGER, I. BUCHBERGER 1999). Subsequent chapters will deal with the development of the electronic textbook on *Didaktik/Fachdidaktik* and present an evaluation of one part of it (cf. S. BERGHAMMER 2000).

This paper does not provide answers or solutions to the many problems with which *Didaktik/Fachdidaktik*, and/or curriculum, and a science of the teaching profession are confronted. It restricts itself to the definition of some main elements of the problem-space.

Space available does not permit to go much into detail. This fact may lead to some misunderstanding, especially when considering the very different background knowledge accumulated in the different cultural contexts of the European Union (cf. different problem-definitions in English-, German- or Spanish-speaking contexts) or the USA. Space available does only permit to consider some selected aspects of the concept *Didaktik/Fachdidaktik*. We will focus in this paper on problems of the selection of aims and contents for teaching/studying/learning and their transformations into learning situations, neglecting consciously other relevant components of the teaching/studying/learning process or the learner him-/herself.

1. High Quality Teacher Education – an Introduction

One might state ironically that education and training have increasingly become big super-markets. Education policy- as well as social policy- and economic policy documents unanimously stress the necessity of human resource development and of high quality education and training for all (cf. European Commission 1995, 1997, OECD 1996, 1998). The argument is put forward that the prosperity of post-industrial information and knowledge driven societies would depend (inescapably) on the optimal development (and exploitation) of the human capital of all its citizens. These societies had *"to transform themselves into dynamic learning societies"* (OECD 1996). The focus of education policy on traditional *"more of the same - rationales"* (modification- and adaptation strategies) is seen as inappropriate to make education and training more efficient (OECD 1996). Considering on one side the amount of problems persisting and on another the rapidly changed/changing contexts (e.g. "globalization", cf. S. AMIN 1997, U. BECK 1997) and conditions (e.g. multimedia revolution, cf. S. TELLA 1998) of and expectations on education and training, both substantial reforms of education and training and an expansion of the education and training sector are perceived to be indispensable *(2)*.

Policy documents mentioned frequently stress the important role education and training establishments, teachers and their education had to play to meet these challenges adequately and to make education and training reforms perceived to be necessary a reality. H. JUDGE (1998, vii) has described the status quo of education reform and the role of teacher education in the United States in his foreword to the evaluation report on the Holmes Commission/Partnership activities (cf. M. FULLAN et al. 1998) as follows: *"The most salient change since 1986 has without doubt been the installation of teacher education reform at or near the head of every agenda for educational regeneration: a hitherto neglected or subordinate theme has become dominant. Just as it has emerged as a commonplace that reform cannot be achieved without good teachers, so it has become axiomatic that good teachers need and deserve a first-class preparation."* But, at the same time, J. SIKULA (1996) has stated in his introduction to the second edition of the "Handbook of Research on Teacher Education" that schooling and teacher preparation have not yet been high priority issues in American education policy.

Comparable to the United States policy documents of the European Commission and the Ministries of Education of its fifteen Member States stress the importance of high quality

education and training for all and the role teachers and TE ought to play. The "Quality" of education and training in general and of TE in particular had to be improved *(3)*. Reforms of TE had to relate to aims and objectives, contents and learning areas, teaching/learning strategies, learning environments as well as to administration and governance issues. However, coherent action cannot always be seen - both at European Commission level and at the level of different Member States of the European Union. Recently, despite of rhetorical agreement education and training reform in general and TE reform in particular indispensable for education reform do not rank top neither on the political agenda of the European Commission nor of most of its Member States (cf. F. BUCHBERGER 1998b, c; F. BUCHBERGER, B. CAMPOS, D. KALLOS & J. STEPHENSON 2000).

1.1 Making Use of Best Knowledge Available

In principle, broad agreement seems to exist on the relevance and importance of best education possible making use of best knowledge available. Following the program of *"second modernity"* (cf. U. BECK 1997) this calls for coherent efforts to produce scientifically validated knowledge and practices. Efforts to produce scientifically validated knowledge and practices neither contradict nor do these imply a devaluation of the relevance of other types of knowledge relevant for education and training (e.g. tacit knowledge or craft knowledge of education practitioners). As both models of (simple) applications of explanatory knowledge ("theories") and models of knowledge transfer have proofed to be rather inadequate (cf. F.-O. RADTKE 1996) problems of different types of knowledge and their relevance for (professional) educators as well as of knowledge transformation have increasingly found attention - a new challenge for TE and educational research?

In every case it seems to be necessary to professionalize *(4)* (teacher) education by adopting scientifically validated knowledge and practices in approximating best education possible. Most conceptions of professionality (cf. A. COMBE, W. HELSPER 1996) include as one core concept the existence of a well-developed science, a scientifically validated knowledge base and practices of/for a particular profession. If teaching should be conceived as a profession, it needs clarification which science or sciences this/these might be and how well this science/these sciences are already developed *(5)*.

(Comparative) Research on TE and its reform (a rather poorly developed field in most Member States of the European Union) has highlighted both a large number of (persisting) problems of TE (e.g. problems with theories of TE as well as methodologies adopted in TE, problems with a research-based knowledge base of/for the teaching profession or with appropriate teaching/learning strategies) and a (sometimes rich) potential to improve it (cf. T. SANDER et al. 1996) - with sometimes big differences between the different Member States of the European Union.

1.2 The Meaning of Didaktik

Against this background outlined this paper will mainly deal with problems with the scientific knowledge base of TE and the teaching profession. It will focus on the role of *"Didaktik/Fachdidaktik"* (DF) as a possible science(-s) of/for the teaching profession.

Without going into detail some terminological remarks have to be made in advance:

- The concept science (*Wissenschaft*) will be used in a rather liberal form following meanings attached to it in continental European cultural contexts. It will in no case be restricted to "natural sciences".
- The concepts *Didaktik* (literally translated as "didactics"), *Fachdidaktik(-en)* (literally translated "subject-related didactics") and *Bereichsdidaktik(-en)* (literally translated as didactics of learning areas) have their origin in German Geisteswissenschaftliche Paedagogik and are closely related to the concept of *Bildung/"education"/"erudition"* (cf. W. KRON 1994, H. SEEL 1999). They always combine aims and contents of teaching/studying/learning processes with all the other components relevant to these processes (e.g. teaching strategies, learning environments). This fact may be brought into relation with problems of intercultural (mis-) understanding.
- Both the terms *Didaktik/Fachdidaktik/Bereichsdidaktik* and the singular/plural with science(-s) reflect uncertainties and may be interpreted as unresolved problems *(6)*.

In a general form DF will be defined as (a) science(-s) of teaching, studying and learning in a learning formation/places recently called schools. It will be conceived as a transformation science dealing in an integrated way with

- actors involved in the teaching/studying/learning process and their actions,.
- contexts of teaching, studying and learning,
- aims and objectives of teaching, studying and learning,
- contents of teaching, studying and learning,
- teaching, studying and learning strategies,
- media and teaching/studying/learning aids,
- evaluation of teaching, studying and learning.

While in most European contexts there seems to exist some broader agreement on the contents of DF as a science (of teaching/studying/learning processes) and to a smaller extent on the seven components mentioned and their (mutual) relations, the terms "transformation science" and "integrated way" will have to be clarified in this paper.

As a science of teaching/studying/learning processes DF aims at the production of

- descriptive knowledge/theories (*Beschreibungswissen*),
- explanatory knowledge/theories (*Erklaerungswissen*), and
- efficiency-oriented knowledge/technological theories (knowledge and measures for interventions dependent on different targets/aims and contextual conditions leading with a certain probability to certain outcomes) (*Veraenderungswissen*).

In producing descriptive and explanatory knowledge D/F follows principles of *"normal science"*. In producing technological theories DF may be seen as a *"design science"*. While European research on teaching, studying and learning has focussed on the production of descriptive and explanatory knowledge, the production of technological theories for teaching/studying/learning processes has been neglected and may be seen as a blind spot. Some education researchers even doubt whether in education technological theories may be possible (cf. for a detailed discussion L.-M. ALISCH 1995) *(7)*.

2. Between the "State of Practice" and the "State of the Art"

In this chapter four statements will be presented to outline the recent situation of ITE and discussed in relation to its knowledge base as well as the knowledge base for teaching/studying/learning processes. These four statements may read as follows:

(1) Teaching and ITE have to be oriented on "state of the art-knowledge".
(2) The "state of practice" of ITE and its knowledge base may be characterized as rather problematic.
(3) (Research-based) Knowledge bases for teaching and ITE do exist, but are used to a limited extent only.
(4) More research on teaching and ITE is indispensable to increase the scientific bases on teaching and ITE both in quantity and quality.

2.1 Teaching and ITE have to be oriented on "state of the art-knowldge".

Let us introduce this first statement by a fascinating court case from the 1930s in the United States involving the T.J.Hooper, a tugboat. This court case has been described in the preface to the AACTE publication "Knowledge Base for the Beginning Teacher" (cf. W. GARDNER 1989):

"The T.J.Hooper and the ship it was guiding got into trouble in the Atlantic Ocean when a storm blew up. The storm damaged the ship and caused injury and property loss to its clients, who promptly sued. At the time common practice among tugs was to get weather information via hand signals from shore. Although radio had been introduced it was not common in use. The T.J.Hooper did not use radio, but if it had, the tug master would have known of the danger and been able to take its clients to shelter, thus avoiding damage to life, limb and property. The case turned on the question of T.J.Hooper's responsibility: was adherence to common practice (e.g. hand signals) enough or did the situation demand "state of the art" (radio)? The courts ruled that, when important matters are at stake, the legal obligation is to use the state of the art. The T.J.Hooper case has been effectively used by educational authorities to demonstrate that in the United States, where schooling of the young is involved, schools must use the state of the art techniques and materials".

In principle, the situation in the Member States of the European Union does not differ substantially from that in the United States. The importance attached to education and training in a "knowledge-driven society" is calling for "state of the art" - solutions *(8)*.

2.2 The "state of practice" of ITE may be characterized as rather problematic.

This paragraph will focus on ITE and its knowledge base. Let us start again with a statement of H.JUDGE (1990, 11): *"Teacher education (in England and Wales) is a product of history rather than of logic"* (adding that much progress might have been made the past few years). This statement seems to hold true for most of the TE systems and programs in the European Union and it refers to substantial curricular problems of ITE programs *(9)*. It might be argued that

- theoretical and research-based argument as well as
- rational system planning or

- the expertise of those involved in ITE

have not always played the most prominent roles in constructing and developing systems and models of ITE. TE curricula and the knowledge provided there reflect in many cases some traditions (e.g. a normal school tradition in TE for primary level teachers or an academic tradition in TE for secondary level teachers) dating back to the 19th century.

To become more explicit: Most programs of ITE in the Member States of the European Union are based primarily on some form of common sense, beliefs, opinions and (unrealistic) expectations (idealizations, illusions) (cf. F. BUCHBERGER 1994, J. OELKERS 1997). They combine some studies in certain academic disciplines with some methodology courses, some (teaching/school) practice and some educational/professional studies. These components mentioned as well as their different (and sometimes rather peculiar) combinations frequently neglect *"state of the art-knowledge"* on

- teaching, learning and TE (cf. L. DICK 1994, F. OSER 1997) as well as on
- sociology of knowledge (cf. F.-O. RADTKE 1996) or
- educational psychology (cf. K. REUSSER 1994).

They may be seen as *"collection code curricula"* consisting of fragmented components with sometimes unclear relevance to teaching and learning, and as rather outdated "technology". Difficulties obvious frequently are circumscribed with the formula "theory-practice-problem". Additionally, these common sense based (curricular) models of ITE may be seen as an enormous waste of resources *(10)*.

Curricular problems of ITE may be explained in a number of ways, e.g.:

1. T.POPKEWITZ (1993) speaks of a *"social arena"* of TE where different interest groups and lobbies try to keep their influence in a social "power game" (e.g. scientific/academic disciplines) and in which adaptations and re-orientations necessary because of changes in the context of schooling are not made *(11)*.
2. Another explanation might focus on general systems theory (N.LUHMANN 1984) and a tendency of systems to inner-systemic differentiation neglecting increasingly the systems environment. Reluctance towards substantial curricular changes may be explained in this way.
3. Educational sciences (including educational psychology or educational sociology) and especially a science of teaching as relatively young academic disciplines could not really establish themselves in many ITE curricula *(12)*.
4. A science of the teaching profession may be seen as not very well developed while much normative (not to say dogmatic) argument and lay - technology (not tested on its effects) seems to dominate especially as regards methodology.
5. A lack of pro-activity of institutions and staff of ITE, who are not always aware of both the changing context of education/TE and *"state of the art-knowledge"* produced in relevant academic fields of study.
6. Problems with the recruitment and the career-structures of staff of institutions of ITE. While decisions to become a teacher are sometimes perceived as "second best choices of the second best" (cf. G. NEAVE 1992), academic careers in TE do not have high prestige in academic circles (cf. exceptions in countries such as Finland).

Similar as with the curricula of ITE applies to the learning cultures adopted in many programs of ITE. Research on teaching and TE has highlighted the importance of the concept of *"powerful learning environments"* (cf. F. BUCHBERGER, E. DE CORTE, B. GROOMBRIDHE, M. KENNEDY 1994). But, the evaluation report on TE in the European

Union (T. SANDER et al. 1996) clearly indicates that many programs of ITE are by and large oriented on outdated knowledge transmission models - a "preaching water and drinking wine-phenomenon"? Similar applies to problem-, project- and research-oriented learning processes in ITE, which have to be missed in many models of ITE in the European Union (cf. as an exception the model of ITE adopted in Finland, F. BUCHBERGER 1995).

As regards the practical/clinical component of ITE programs rather outdated apprenticeship models or models oriented on the formula "practice-relevant experiences" seem to dominate. Again, knowledge and practices available to provide "powerful learning environments" for prospective teachers to acquire a flexible repertoire of teaching actions is used to a limited extent only. Although a coherent and by specially educated staff provided supervised teaching practice component (in co-operative problem-solving groups) may be seen as a necessary condition for high quality ITE (e.g. H. BRENN et al. 1997), most models of ITE do not adopt the knowledge bases and scientifically validated practices available.

A coherent knowledge base component, an elaborated clinical component and a research component as well as their integration within ITE programs still have to be missed. It would be easy to continue with methodological shortcomings of ITE and this might again result in a long list of claims. In short, ITE programs do not make intensive use of research-based knowledge and scientifically validates practices, and this fact may be seen in close relationship with unclear aims and goals of ITE (cf. M. KENNEDY 1990), superficial and sometimes irrelevant content, sub-optimal methodologies and rather inappropriate learning cultures counterproductive to aims declared.

It is worth mentioning that some models and programs of ITE in Member States of the European Union may be seen as counter-examples on what has been outlined before. This applies in many ways to ITE at Finnish universities (cf. F.BUCHBERGER 1995). In addition to some promising approaches all over the European Union these approaches may bring about much input to improve the quality of ITE *(13)*.

2.3 (Research-based) Knowledge bases for teaching and ITE do exist, but are used to a limited extent only.

Much research-based knowledge has been developed on teaching and learning and to a smaller extent on several aspects of TE (e.g. The Handbook of Research on Teaching edited by M. WITTROCK 1986, The International Encyclopedia of Teaching and Teacher Education edited by L. ANDERSON 1995, The Handbook of Research on Teacher Education firstly edited by W. HOUSTON 1989 and then by J. SIKULA et al. 1996, The International Handbook of Teachers and Teaching edited by B. BIDDLE et al. 1997, or The Knowledge Base for Beginning Teachers edited by M. REYNOLDS 1989).

Making use of this knowledge in teaching/learning in education at school or in TE programs might lead to substantial improvements and help to reduce sometimes severe shortcomings (e.g. predominance of knowledge transmission models of teaching). At the level of political decision making, at institutional level (school) and at an individual level (classroom/learner/teacher) these scientific knowledge bases might contribute to more adequate decisions and better outcomes *(14)*.

At that point it may be asked:

- Why are research-based knowledge and scientifically validated practices used to a limited extent only by institutions of TE and teachers?
- Why are most institutions of ITE rather reluctant to contribute pro-actively to an increase of the scientific knowledge bases of teaching and TE?
- Which conditions may be made accountable that education politicians in some Member States of the European Union do neglect *"state of the art–knowledge"* on teaching/learning and TE, and in some cases even counteract, when calling at the same time for reform and improvement of TE ? *(15)*

Making use of scientific knowledge bases on teaching/learning and TE several commissions and committees have presented proposals to improve the curricula of ITE (cf. The Holmes Commission 1986, 1995; Bildungskommission NRW 1995; DGFE 1997, KMK 2000) the past few years. Considering a large number of knowledge submitted by the social sciences in general and the educational sciences (*Erziehungswissenschaften*) in particular Bildungskommission NRW has submitted a proposal for reform containing aims, content and methodologies for ITE programs (embedded in an overall framework of schooling in general and TE in particular). Integrated into research-based knowledge problem-oriented, research-oriented and co-operative learning processes within ITE should contribute to the development of the following professional action structures/competencies of (beginning) teachers (and each competence is split up into three to five sub-competencies):

- subject-related and "didactic" competence
- methodological competence (e.g. a broad repertoire of teaching/learning methodologies)
- competence to manage learning groups
- diagnostic competence
- competence for counselling
- meta-cognitive competence
- competence to deal with (new) media
- competence for collaborative problem-solving

This coherent set of professional action structures/competencies may form the substance for the development of curricula of ITE and replace the rationales of common sense based curricula *(16)*. While Bildungskommission NRW has submitted a proposal which mainly adds insights of different paradigms in a challenging way, it has not been able to submit an integrated approach. It has not been able to integrate studies in educational sciences, *Didaktik/Fachdidaktik* and studies in different academic disciplines – a missing link problem?.

As regards the clinical component of ITE, much knowledge has been accumulated on its effective organization. The concepts of action research or of reflective practice might provide much input for more effective ITE. Similar applies to teaching/learning strategies. Knowledge on establishing "powerful learning environments" in ITE is still available, but used to a limited extent only *(17)*.

2.4 More research on teaching and ITE is indispensable to increase the scientific knowledge bases on teaching and ITE both in quantity and quality.

At the meeting of the Standing Conference of Ministers of Education of the Council of European Union the Swedish educational scientist U.LUNDGREN (1987) said: *"The amount given to research in education compared to the costs of education as a whole is minimal. If this fact is related to the demands on education the situation may be characterized as absurd. Even though comparisons of this sort are problematic, a comparison with companies or medical welfare underlines this absurdity. A company which were to plough back as few of its resources into research and development would not survive for long"*. This statement explicitly refers to one of the basic problems of education and TE: high expectations expressed, but a restricted commitment to fund research and development indispensable to improve them - a "knowledge driven society" without sufficiently developed scientifically based knowledge?

Proposing that more research is needed may sound popular, but not necessarily creative. As regards ITE the following aspects seem to be of highest relevance:

- ITE has to incorporate a clear (educational) research component into its curricula.
- It seems to be indispensable that institutions of TE develop a clear commitment to (educational) research.
- Prospective teachers may be provided with curricula and learning situations which give them ample opportunity to become competent both in understanding educational research and in transforming it into pedagogical professionality.
- Prospective teachers have to be given opportunity to become "critical action researchers" (cf. J. ELLIOTT 1998).
- Teacher educators have to become (educational) researchers themselves *(18)*.
- Finally, living in times of ambiguity and contradiction it may be asked which types of research identities might be adequate for (teacher) education ? (cf. J. ELLIOTT 1998).

As regards a scientific knowledge base for teaching and the teaching profession more integrative research and development seems to be necessary. Integrative research and development will have to combine all forms of scientific knowledge relevant for teaching/studying/learning processes in a specific format, which includes a coherent treatment of aims, contents, procedures (e.g. teaching/learning strategies) and all the other components of *Didaktik* mentioned. A differentiation into different types of knowledge and there addition as proposed by L. SHULMAN in the late eighties (1986, 1987) may have pointed to some neglected areas, but would need more radical reformulation.

3. DF conceived as an integrative transformation science might have the potential to become the main science of/for the teaching profession.

Before the concept of DF as an integrative transformation science will be described some additional arguments will be presented in support of the necessity to conceive DF as a science of/for the teaching profession.

3.1 Arguments in support of DF as an integrative transformation science

(1) One of the main leitmotifs in improving TE and education at school the past thirty years has been "professionalization" of teaching and TE. Adopting an approach of pedagogical professionality (cf. A. COMBE, W. HELSPER 1996) pedagogically professional actions may be conceived as cogent and justifiable transformations of scientifically based knowledge and practices on education, teaching and learning to particular cases by specially educated/trained personalities (education staff) considering the interests of the clients (e.g. students) involved. Both as prerequisite and consequence scientifically based knowledge and practices on education, teaching, studying and learning have to exist.

(2) For the teaching profession it has remained debatable, which science(-s) might form its scientific knowledge base(-s). As regards education at (lower and upper) secondary level of the school systems in most of the Member States of the European Union (prospective) teachers receive much training in (frequently two) academic disciplines, while a preparation for the main tasks of teachers (educating - providing teaching-studying-learning environments) is perceived of minor importance. In most countries (prospective) teachers do not graduate in education (or educational sciences) but in other academic subjects. This fact may have tremendous impact on the development of professional identities of (prospective) teachers. In addition to basic problems of rather reluctant education policy decision making behaviors several problems of integrative theories of teaching and learning as well as theories of TE might be made accountable to this fact.

(3) Recently, syllabuses as well as (national) curricula of most of the Member States of the European Union may be evaluated as common sense based and explainable in historical terms only. They have to be seen as collection code syllabuses/curricula

- not always compatible with changed/rapidly changing tasks and expectations of society (cf. European Commission 1996) or
- the progress of scientific disciplines as well as
- changed patterns of knowledge production.

Substantial reforms or restructuring of syllabuses and (national) curricula are still pending in most European Union Member States. Coherent curriculum research might have become indispensable. The focus of existing syllabuses and (national) curricula on some academic disciplines has to be seen as rather problematic in at least four ways:

- The fragmentation of syllabuses/curricula into (school) subjects corresponding to certain academic disciplines may be seen as a debatable pattern of organization of teaching/learning closely related to (since several years outdated and not any more adopted) industrial modes of production (cf. Taylorismus vs. Post-Fordismus).

- The question still remains debatable, why certain academic disciplines have been incorporated into the syllabuses/national curricula and others have been rejected or are neglected recently (e.g. communication sciences, law, medicine).
- A (sometimes hidden) assumption may be detected, in which a correspondence of a particular academic discipline with a particular subject at school is stated. While H. SEEL (1998) has analyzed that this assumption is inappropriate for the (school) subject geography, I. BUCHBERGER (1999) has submitted argument that mother tongue teaching/learning as subject at school has to integrate knowledge produced independently in more than 14 and rather heterogeneous academic disciplines. However, in attempts to establish a (school) subject "media culture competence" in the German education system J. SCHOENERT (1998) makes reference to 23 different academic disciplines.
- The difference between the aims and tasks of (many) academic disciplines (production of explanatory knowledge structured systematically in propositions) on the one side and the aims of teaching/learning on another side is neglected in many ways leading to severe problems.

(4) Closely related to what has been said above ITE and its programs are split up into different and in many cases unrelated (academic) disciplines. These academic disciplines focus on the development of scientific knowledge/explanatory models and theories, and do not consider the phenomenon of teaching/studying/learning particular topics.

The transformation of scientific knowledge structured systematically into (human) knowledge structures following different patterns of organization (e.g. holistically, episodic) frequently can not be seen as an aim of academic disciplines and their fields of knowledge production..

Additionally, a number of academic disciplines oriented on a philological tradition seems to devaluate the relevance of scientifically validated practices and does show only limited interest in developing them which may be perceived as problematic when it comes to teaching/studying/learning phenomena analyzed by these academic disciplines.

(5) Teaching, studying and learning processes may be defined as the central content areas of a science of/for the teaching profession. Teaching, studying and learning always

- take place in certain contexts/environments (e.g. macro-systems, meso-system particular school, micro-system learning environment and learning situations),
- have to be seen primarily as intentional actions of the actors involved
- directed towards aims and objectives,
- have substance/content, and
- may be supported by different media (e.g. teachers, teaching/learning aids).

The focus is on the studying/learning processes of the student who has to be provided with learning situations appropriate that he/she can develop/construct his/her structures of meaning, knowledge and action. Supporting the construction of meaning on one side and on another side the transmission of explanatory knowledge of certain academic disciplines are rather different phenomena.

(6) In a number of European cultural contexts *Fachdidaktik(-en)* in/of various fields could establish themselves as academic disciplines and have sometimes made remarkable progress. Various *Fachdidaktik(-en)* may recently provide scientifically based knowledge and practices for teachers to establish learning situations in their respective fields. They have (for long)

been able to achieve what L. SHULMAN (1987) has defined as pedagogical content knowledge.

However, in many cases a tendency to isolate particular *Fachdidaktik(-en)* (even from neighboring ones) may be observed. Expectations of particular *Fachdidaktik(-en)* related to different academic disciplines and their structures might have become predominant. The studying/learning processes of students might have become of secondary importance only. Are *Fachdididaktik(-en)* able to define for themselves criteria for justifiable aims of the holistic development of *Bildung/education/erudition*, and if, which criteria may be adopted by *Fachdidaktik(-en)* to relate defined subject-specific aims to more general and holistic aims of *Bildung/education/erudition*? A frequently given justification of particular *Fachdidaktik(-en)* on the argument that they had to provide scientifically validated knowledge for different school subjects as these have been defined by education politicians in (national) sylabusses/curricula might give an impression of superficiality *(19)*.

(7) The explosion of scientific knowledge and the process of fragmenting knowledge may be seen in close relationship with an increasing illiteracy - even of highly educated personalities - in an increasing number of content areas. Procedures of knowledge transformation seem to become indispensable - another case for DF as an integrative transformation science of/for the teaching profession?

(8) The production or design of scientifically validated practices and educational software may be seen as a rather neglected field of *Didaktik* as well as *Fachdidaktik*.

Designing educational software calls for the co-operation in collaborative problem-solving groups comprised of experts in a number of different fields (e.g. *Didaktik/Fachdidaktik*, educational psychology, linguistics, communication sciences, information and communication technology). In most countries of the European Union DF did not really cultivate the possible task of producing educational software and has given free way to marketization in this field with outcomes obvious. It will be suggested that DF as an integrative transformation should deal with the production/design of scientifically validated practices and educational software. Maybe, it could then reduce technological deficits obvious in the field of teaching, studying and learning hidden behind well-sounding formulae (e.g. "theory-practice-conflict") *(20)*.

The availability of empirically validated practices and educational software seems to be a necessary condition for teacher professionality (compare in this respect medicine with teaching). The role of teachers would become more important in making decisions as regards the transformation of this knowledge and practices to particular learners, aims, contents, and contexts.

(9) Teaching, studying and learning processes in places called school may be defined as central content areas of DF, but the relative relevance of teaching and learning in places called school in relation to other sources of learning (e.g. home, peers, community, mass media and the net) has to be considered in DF as an integrative transformation science.

3.2 DF as an integrative transformation science

Against this background outlined a (preliminary) structural model of DF as an integrative transformation science may be brought to discussion as follows:

(a) The model of DF as an integrative transformation science consists of 4 different levels linked together by 3 different transformation processes.

(b) At a first level we differentiate into "general knowledge of society" and "(scientific) knowledge" produced by the many different academic disciplines. The category "general aims of society" may be conceived as general (and in particular societies to a large extent collectively shared) patterns of interpreting phenomena of live and the world manifested in not very precisely defined (general) aims (*gesellschaftliches Deutungswissen einschliesslich unspezifizierter Absichten/Rahmenzielstellungen*). The category "(scientific) knowledge" refers to the huge amount of knowledge (and technologies) produced by the sciences.

© "General knowledge of society" and "(scientific) knowledge" are either too unspecified or too extensive to get relevance for teaching, studying and learning. Both have to be transformed for teaching, studying and learning (transformation 1).

General (and sometimes contradicting) knowledge of society needs to be transformed into more specified aims for teaching and learning. Concepts such as *Bildung/education/erudition* may have important roles to play in this transformation process (cf. W. KLAFKI 1992 and his concept of *Allgemeinbildung/"general education/erudition* oriented on key-problems of society).

Systematically structured, explanatory knowledge of particular academic disciplines has to be transformed into knowledge structures (e.g. problems, cases, schemata).

Both transformations within the first transformation process may not be seen independently. While many interactions exist between "general knowledge of society" and "(scientific) knowledge" and its production, dialogues between representatives of society (democratically legitimated authorities) and the DF research community may be seen as imperative in transformations necessary. As regards the transformation of "(scientific) knowledge" into knowledge structures the dialogue between representatives of the different academic disciplines and the DF research community may be seen as a necessary condition.

(d) More "specified aims" and "knowledge structures" may be seen as the second level of the DF-concept. Both form a broad and potential pool of aims and knowledge structures to become subjects of teaching, studying and learning.

(e) In a second transformation process more specified aims and knowledge structures have to be integrated to possible "thematic units" or "themes" (*thematische Lernangebote*) for teaching, studying and learning. Considering

- on the one side the many aims possible and the huge amount of knowledge structures available and
- on another side the limited resource human information processing capacity and time available

transformations of type 2 are indispensable.

Transformation 2 has to result in a justifiable pool of "themes" or thematic units.

(f) "Thematic units" or "themes" conceived as coherent sets of aims and content may be seen as level 3 of DF.

(g) In a third transformation process "thematic units" are transformed into concrete learning situations (level 4). Learning situations may be characterized by the following components:

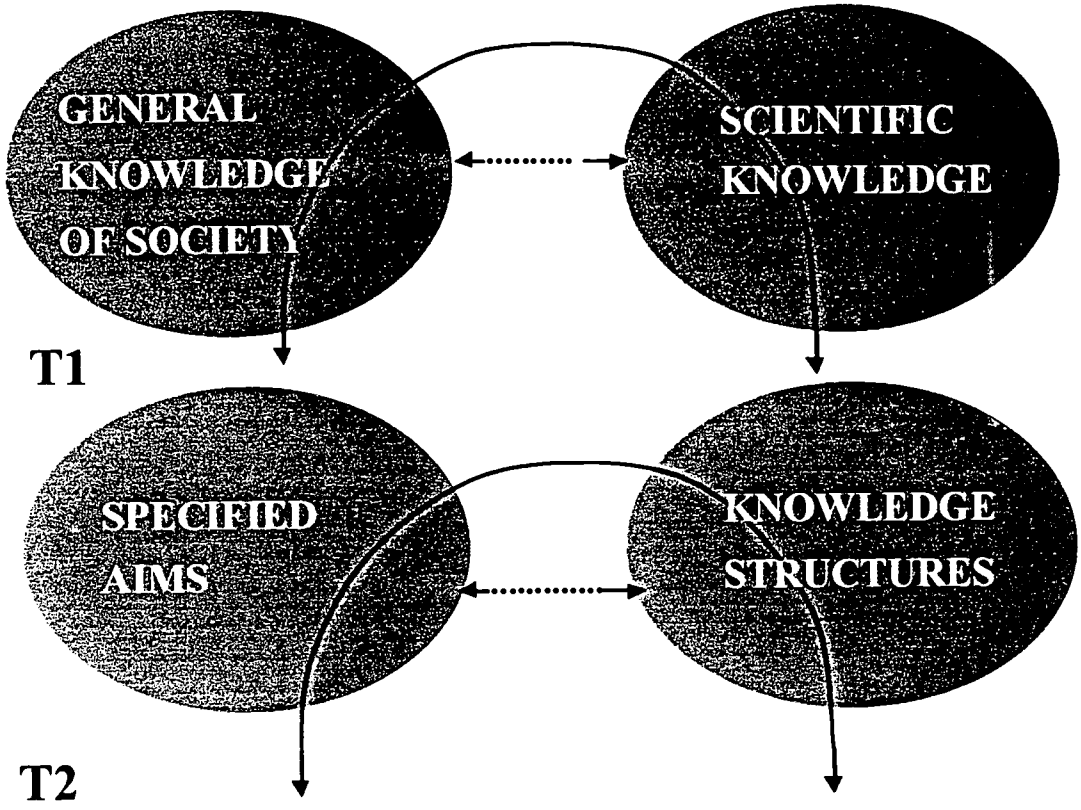
- context,
- actors (e.g. teachers, learners), their characteristics and actions,
- aims and objectives,
- content/substance,
- teaching/studying/learning strategies,
- evaluation procedures, and
- media.

(h) Having categorized "general aims of society" and "(scientific) knowledge" at the first level of the concept and "learning situations" at the fourth does not imply superiority of the first or less relevance to the category "learning situations". The model of DF as integrative transformation science intends to outline the integrated nature of the phenomenon under discussion which may not be reduced to one or the other category/level or transformation.

The model of DF outlined might have enormous impact on

- restructuring TE (e.g. orientation on teaching, studying and learning processes instead on academic disciplines),
- the organization of teaching and learning in schools (e.g. orientation on learning situations and thematic units/problem areas instead of subject-matter structures) and
- the teaching profession (e.g. solid scientifically validated knowledge and practices should contribute to empowerment and reduction of dependencies from external and political control as well as from non-teaching related academic disciplines).
- Additionally, DF conceived as an integrative transformation science would open up new opportunities to tackle another problem of teaching and learning widely neglected. It could provide a framework for the production of empirically validated teaching and learning technology/*Veraenderungswissen* (e.g. net-based learning environments and software) comparable to standard treatments in the medical sciences.

DF as an integrative transformation science



L1

L2

THEMATIC UNITS

L3

T3

LEARNING SITUATIONS

L4

Actions
Context
Aims
Content
Strategies
Media
Evaluation

4. Developing DF as a science of the teaching profession

Systems and programs of TE in the Member States of European Union may be characterized by some common elements and a rich variety of differences (cf. F. BUCHBERGER , B. CAMPOS, D. KALLOS & J. STEPHENSON 2000). Within these systems the role of scientific knowledge on teaching and learning is interpreted very differently and may range from a negative appeal and ignorance to high esteem and highly developed academic cultures. This fact may be seen in close relationship with the state of development of a scientific knowledge base for teaching and learning. While some systems of TE have still remained in a pre-scientific state and focus on dogmatic, not to say prescriptive methodologies, others have been able to make use of scientific knowledge and have developed research and development cultures. With good reason one can propose that some basic elements of a science of/for the teaching profession have been developed which may form valuable bases for the further development of a science of/for the teaching profession (e.g. the research and development cultures at Finnish departments of TE at faculties of education at universities. Similar observations apply to research and development centers for particular fields of teaching and learning (e.g. Institut fuer die Didaktik der Mathematik, Bielefeld/Germany) established in the seventies.

Developing a science of/for the teaching profession has to consider insights developed by innovation theory and has to be conceived as a change of a social (academic) system. In addition on what has already been said on restructuring curricula of ITE and schools the following proposals will be made to establish and to develop DF as a science of the teaching profession:

- If institutions of TE make use of *Wissenschaftsdidaktik* ("methodology of higher education") and transform principles developed there to its own curricula and teaching/learning situations, first progress may be expected.
- Institutions of TE should be encouraged to establish co-operative problem-solving groups consisting of staff/researchers of different academic specialization and background and practicing teachers. They should be encouraged to research on concrete problems/projects in an integrated way. DF cannot be conceived as a science of someone (researchers) for someone else (teachers).
- In institutional terms faculties of education seem to have high potential to provide appropriate research and development cultures.
- Centers of excellence might be established doing research and development in selected teaching/learning areas (e.g. Center for Multimedia Education at the department of teacher education at Helsinki University, S. TELLA 1998).
- If statements in education policy documents (e.g. European Commission 1995) intend to be more than lip-service, then coherent action at European Union level seems to become indispensable. We suggest to establish an all-European task force on teaching and learning dealing with problem areas mentioned in this article pro-actively and constructively. A special chapter on this issue might be included into the targeted socio-economic research program (TSER) of the European Commission to provide resources necessary.

Additionally, problems to be solved cannot be tackled adequately by one person, a small team of specialists in a particular field of inquiry or a particular research tradition alone. Inter-disciplinarity and co-operation in collaborative problem-solving groups have become indispensable. Considering the limits of human information processing capacity this fact again calls for co-operative problem-solving groups comprised of people with

Didaktik/Fachdidaktik expertise, cognitive scientists, subject specialists, media experts, and teachers. It seems to be necessary that rather individualistic and disciplinary-bound cultures of research and development have to be replaced by co-operative ones (cf. L. SHULMAN 1987 and his remarks on searching for missing links in research on teaching and learning).

But, many patterns of organization at universities and corresponding cultures of research and development may be seen as sometimes severe obstacles. If actors will avoid co-operation and neglect integration centered around the teaching/studying/learning process, and will not pro-actively make use of effects of synergy as well as scientific knowledge bases existing (and to be developed), they may find themselves easily - or remain - in the position of the famous German baron Muenchhausen, who tried to pull himself on his tuft out of swamp - without success.

5. EMDID – an electronic, adaptive and cross-European textbook on DF

Oriented on the concept of DF outlined and adopting principles defined for the development of a science of/for the teaching profession a cross-European team of teacher educators has begun in 1998 to develop this electronic, adaptive textbook on DF. Development work is in progress, and the alpha-versions of some parts have been tested on their effects and efficiency recently.

Considering the general concept outlined the different parts of the electronic textbook deal with particular topics (e.g. "Schooling, Bildung/education/erudition, teaching", components of the teaching/studying/learning process, evaluating curricular material, integrated math education, integrated language learning). A key-word index and a link structure provide opportunities for cross-reading/studying and give learners the possibility to construct learning-paths of their own.

In addition to the texts provided EMDID offers different corporate work-spaces, which can easily be established by the participating students and staff as well as program developers. It is intended to use these corporate work-spaces for the learning of multi-nationally composed learning groups. In addition facilities for cross-European tele-tutoring have been provided. First experiments with tele-tutoring have brought about a number of insights (e.g. on establishing permanent learning groups and social conditions of co-operation) - and problems (e.g. diversity of European languages and the use of English as lingua franca, rather rigid regulations in a number of European institutions of teacher education).

The evaluation of the module "Schooling, Bildung, Teaching" has brought about the following results (cf. for more detail S. BERGHAMMER, in press):

A cohort of 146 student teachers learning with the electronic textbook was compared with 112 students receiving traditional forms of instruction on the same topics in a lecture hall on another campus. The treatment group had all information available at a website at the beginning of the term and opportunity to co-operate in corporate workspaces both with other students and staff responsible for the lecture. In addition, students had opportunity to participate in meetings at which the contents of the web-information were discussed.

Evaluations on the quality of the two treatments and the perceptions of the learning cultures brought about significant differences in all items asked for. While the attendance of students in the control group was less than 30%, the members of the control group had an average attendance rate of more than 80%.

While some 15% of the students in the treatment group had problems with working with the web and the corporate workspace, more than 40% of the students took more than 30 visits at the website and the corporate workspace. In addition, more than 80% of the co-operating teachers attached to the students in the treatment group hosted the EMDID website.

Assessments on the knowledge acquired (by paper and pencil test) brought about again significant differences between the treatment group and control group. Similar results have been produced in essays students had to produce on two professionally relevant problems (and for which they themselves could select the topic out of a list of 25 problems). Students in the treatment group produced essays containing more, and more coherent, argument based both in literature and personal reflection. The transformation of knowledge acquired into concrete lesson plans (in the subject-matters German, English and math) gave again significant differences. Students in the treatment group have been able to submit more appropriate lesson plans (e.g. more coherent definition of objectives for particular lessons, integrating learning theory and structure of lessons). The reasoning on lesson plans (e.g. number and quality of arguments) submitted has been much better in the treatment group.

We are very well aware that the study of S. BERGHAMMER has to share the many problems of teacher education research reported in W. HOUSTON (1990). However, we have learned a lot on some essential conditions of net-based lectures. In addition, we have learned more on the effects of an approach providing student teachers opportunities for studying/learning on teaching/studying/learning processes in an integrative way.

Remarks

(1) The concept *Didaktik* has high relevance in the education discourse in most European contexts. A number of German-Nordic-British-American symposia on "*Didaktik* and/or Curriculum" (cf. B. Gundem, S. Hopman 1998; S. Hopman, K. Riquarts 1995) has highlighted both big differences and a number of similar aspects across contexts. Although the British/American meaning of *Didaktik* is closely related to rather narrowly conceived prescriptions (for teaching), we prefer to use the concepts *Didaktik, Fachdidaktik and Bereichsdidaktik* as science(-s) of teaching and learning or as science(-s) of teaching/studying/learning processes as adopted in most European contexts. We hope that this paper will be able to make the differences explicit between the British/American and German/Nordic meanings of these concepts and to provide input for joint discussion and research on teaching/studying/learning processes (cf. M. Uljens 1997).

(2) In these first two paragraphs commenting major education and training policy documents we have frequently used the notion "perceived". This decision reflects the fact that (education) policy documents make use of the language of policy and aim at establishing certain patterns of discourse and thinking closely linked to the interests of particular political groups (e.g. neo-liberals). In this perspective policy documents reported and issues contained in them may be seen as subjective interpretations and perceptions, not as "facts given" or "inescapable trends" (cf. J. ELLIOTT 1998 and his comments on this phenomenon in dealing with education research identities).

(3) "Quality" has become a slogan/formula with ambiguous meaning(-s) since the late eighties and has increasingly begun to dominate the education discourse (cf. F. BUCHBERGER, K. BYRNE 1995). Recently, it may be seen as one of the key concepts of so-called New Public Management (NPM) aiming at a substantial restructuring of organizational and administrative patterns of education and training establishments (cf. H. FORNECK 1997 and his critical comments on discrepancies between aims of education and aims of NPM).

(4) The concept "professionalization" has very different meanings in different European cultural contexts (cf. thematic issue on professionalization of the European Journal of Teacher Education, 2-3/1994, R. BOURDONCLE 1994) which may be seen as a source of much misunderstanding. In addition to sociological interpretations of professionalization we interpret this umbrella concept as *"paedagogische Professionalitaet"* (pedagogical professionality) (cf. A. COMBE, W. HELSPER 1996, H.-J. WAGNER 1998).

(5) R. Kuenzli (1998) has recently addressed the problem how well a science for/of the teaching profession (*Didaktik*) had to be developed and has submitted arguments to conceive it (recently) as a *"popular science"* (*"propaedeutische Populaerwissenschaft"*).

(6) W. KRON (1994), H. SEEL (1999) or P. KANSANEN, M. MERI (1999) have submitted more differentiated categorizations of the field of *Didaktik* adopting criteria such as general - specific, content/subject matter or age.

(7) Schooling has to be seen as an effort based on a(-n implicit) technological theory (cf. the expectation that different treatments will lead to certain predictable outcomes), and there is much evidence that it is – by and large – an effective one (cf. J. Oelkers 1995). At the same time theories of human and social systems have much empirical support that in autopoietic

systems technologies seem to be impossible. We will not be able to solve this discrepancy at that moment. We hold the opinion, that adopting empirically validated technological theories might lead to more appropriate outcomes in relation to defined aims/targets without being able to describe or to explain internal processes taking place in the minds of individual learners or in concrete teaching situations. Assumptions of linearity between input and outcomes seem to be inappropriate. At the same time we se much potential for improvements of teaching/studying/learning by adopting technological theories.

(8) The "T.H.Hooper" - decision of the US Supreme Court had substantial impact on special needs education in the USA. In analogy to it parents received the legal right for best education provision for their disadvantaged children. It would be a fascinating case, if parents in the European Union would sue providers of (compulsory) education because of sub-optimal education provision (not following the state of the art knowledge on teaching/learning and sometimes rather problematic in relation to the Declaration of Human Rights) in various cultural contexts of the European Union.

(9) J. LANIER, J. LITTLE (1986) have described the many problems of curricula of ITE in the United States; J. OELKERS (1996, 1997) has submitted cogent analyses on the problematic state of ITE curricula in German speaking contexts.

(10) Studies on the effectiveness and efficiency of ITE have still to be missed. Recently a big study in Switzerland has tried to provide answers to this problem (cf. F. OSER 1997). Additionally, it is frequently noted that effects of ITE "are washed out" when young teachers enter the teaching profession (cf. H. VONK 1994), that a "culture of induction" has not fully been developed, and that "learning/professional development" at the working place school and its cultivation may be seen as blind spots of TE (F. BUCHBERGER 1994). These facts may be brought into close relation to a sub-optimal use of (especially human) resources.

(11) As regards syllabuses E. WENIGER has stated that syllabuses/curricula have to be seen as outcomes of struggles of different political and social groups. J. OELKERS (1994) has analyzed the influence of the (nation) state and governments on curricula of ITE in Germany and has spoken of the influence of "Staatspaedagogik".

(12) J. OELKERS (1996) has analyzed a rather ambivalent relationship between the development process of educational sciences and TE in Germany. B.REYNOLDS 1998 has claimed the non-existence of educational sciences in England (while submitting the same time a rather narrowly conceived conception on it focussing on research on effectiveness of teaching and learning).

(13) cf. the model of ITE oriented on professional standards (F. OSER 1997) or the descriptions of some reform projects of TE in Germany (M. BAYER. U. CARLE & J. WILDT 1997).

(14) In a rather neutral form we have used the terms "making use of" scientific knowledge and that it might "contribute" to more adequate solutions. This reflects a position which acknowledges (i) the relevance of different types of knowledge (e.g. explanatory knowledge, "tacit" knowledge, action-relevant knowledge), and (ii) takes into consideration social as well as affective components. Additionally, this use of terms reflects uncertainties on the relations of different types of knowledge. There is much evidence that the potential of simple *"knowledge application models"* (of explanatory knowledge structured systematically in propositions to concrete problems) and *"knowledge transfer models"* seems to be rather

limited. More research on models of knowledge transformation seems to be necessary (cf. F.-U. KOLBE 1997, F.-O. RADTKE 1996).

(15) cf. for the situation in England several articles in R. MC BRIDE (1996), or in a more international perspective contributions in M. WIDEEN, P. GRIMMETT (1995).

(16) While the model of Bildungskommission NRW reflects a challenging concept for TE reform as regards aims, content and methodologies, organizational as well as institutional issues are addressed in a rather conservative way and might be interpreted as an avoidance behavior of reformers considering power structures in the "social arena" of TE (cf. F. BUCHBERGER 1998 a).

(17) D. STERN, G. HUBER (1997) have submitted a comprehensive report on active learning in eight OECD member states. An all European consortium is working on a Socrates curriculum development project (ALERT) making use of active learning methodologies in ITE. This project combines the potential of cognitive psychology, learning ecology, different European reform pedagogies, and net-based learning (cf. F. BUCHBERGER 1999).

(18) Transforming ITE into the higher education sector of the education system in German speaking Switzerland has brought about heated discussions on the role of research in ITE. While these discussions have led - intellectually - to clarifications on the role of research in ITE, (possible) solutions seem to reflect again more power structures in a social arena than rational argument (cf. S. GROSSENBACHER et al. 1998).

(19) In a rather tough way the Konferenz der Vorsitzenden Fachdidaktischer Fachgesellschaften in Germany has criticized efforts to establish more integrated models focussing on domain specific didactics (*Bereichsdidaktiken*) instead of subject-related didactics in research and TE (e.g. *Bereichsdidaktiken* as "super sciences"). Unfortunately, rational argument has not been provided against *Bereichdidaktiken* - a case of power games in the social arena TE?

(20) In most education circles in German speaking countries "technology" or "technological theory" are perceived as "nasty words", and there are frequent doubts whether educational technology might even be possible. A comparison with health/medicine and "standard treatments" of medicine such as antibiotica might bring about new definitions of the problem space of teaching/studying/learning.

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